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# WATERSHED FORESTRY TO SAFEGUARD OUR SOIL, WATER, AND TIMBER

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FOREST EXPERIMENT STATION
Columbus 15, Ohio
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TECHNICAL PAPER NO. 119 MARCH 1951

This paper was presented by

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U. S. Forest Service

at the Forty-seventh Annual Meeting of the Ohio

Forestry Association, Columbus, Ohio, January 26, 1951.

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JUN 17 2008
CATALOGING PREP

During the summer of 1949, through the courtesy of Dr. Mitchell of the Central States Forest Experiment Station, I was privileged to observe land use and strip-mining practices in various parts of Ohio. The first "strip mining" that came to my attention was on the upland farms themselves. Here in many cases old-fashioned and inefficient methods of farming were effectively stripping the topsoil--and subsoil as well--from the steep slopes. This was strip mining with a vengeance, little different in principle from the methods which the coal operators were using to get at the "black gold" beneath the hills themselves. One marked difference between the two kinds of strip mining was that a much larger area was apparently being damaged by wasteful farm practices than by coal operations.

I would not venture to say how seriously strip mining for coal will hurt the surface and ground water resources of Ohio and other affected localities. Much will depend on how well the overburden is disposed of and how effectively research workers can find ways to make these areas productive. Perhaps the over-all effects may not be as deplorable as a quick glance at the unsightly spoil banks may lead one to assume. But I feel sure that there must be a far greater loss to the people and to the resource-base of Ohio and the Ohio River Basin from the widespread mistreatment of soils and forests than from industrial strip mining.

More and more people are recognizing the danger that such situations will get out of hand. Within Ohio itself we have as evidence the constructive and farsighted efforts of people like your own Louis Bromfield, and the Muskingum Conservancy District and other state and local conservation agencies and associations who are cooperating closely with federal research and service technicians in this state.

Now we are faced with a serious national emergency. We will need to think harder than ever on how we can assure ourselves of a steady supply of the basic raw materials--and the sturdy manpower--we must have to maintain our full national strength. The memories of the wastes and--in far too many cases--the complacent abandonment of tested conservation practices during World War II are still too fresh to ignore in planning today for a situation which may last longer than most of us at this meeting. Those who appreciate the close interdependence of water, land, and people are keenly aware that we must not overlook this interdependence in preparing for what may lie ahead.

We have already taken a big step in the right direction. Gone--or rapidly disappearing--is the naive notion that forests, or soils, or water can separately be studied, improved, or managed without recognizing that each is only one part of an organic whole. Similarly discredited is the once tenaciously-held idea that watersheds and waterways are separate, unrelated organisms whose ailments can be treated separately. We have concentrated so much on treating the symptoms of diseased watersheds that we have all but forgotten the watersheds themselves.

The results of such neglect, or at best inadequate diagnoses and treatments of our ailing watersheds and waterways, are too well and painfully known to require more than passing comment. They are revealed in the steadily mounting toll of flood and silt damages--reflected only in part by property losses estimated at some billion dollars per year, well over half of which occur on the smaller tributary streams which suffer the most frequent floods. They show up in serious shortages of surface or ground water in most parts of the United States; in loss of soil fertility--and too frequently soil itself--from the cultivated, forest, and grass lands which yield our water supplies as well as food and fibers.

The recently published voluminous report of the President's Water Resources Policy Commission, "A Water Policy for the American People," comes at a most opportune time. This is a thoughtful, fascinating, and provocative document. Prepared by a corps of experts in many fields, it represents about a year's intensive study of the best available information and a thorough analysis of public opinion. It should help us understand the causes of our present land and water problems, and provide us with sound principles for a sensible approach to their solution.

Briefly, the report calls attention to the economic and social difficulties which have grown out of the wasteful use of water, soil, and other resources. It stresses the oft-repeated but commonly ignored truism that land and water programs must be undertaken--not piece by piece--but in a way that recognizes each activity profoundly affects the other. It shows how our failure to apply a unified approach has produced only partial and uncertain benefits and too often created new situations as serious as those the remedies were intended to correct. It points to the wisdom of recognizing all possible uses of a river and its drainage basin and of harmonizing the various aspects of resource development to assure the greatest and most lasting benefits to public and private interests.

Significantly, the Commission's report urges that responsibility for river-basin programs be shared by every one of us as individuals, and through local, state, and Federal governments. It urges us to place the long-run national welfare and security above narrow dollar considerations in deciding whether or not to improve a given watershed and how far to go in rebuilding damaged lands and their waters. Finally, the report recommends a national water policy providing, among other things, for a review of all existing river-basin programs, and for stepped-up watershed research and basic data investigations so necessary to assure balanced, permanent programs.

The Commission's statement on watershed management (Chapter 9 of the Report) encourages foresters and other conservationists who have long realized that watershed lands should receive early and adequate attention in the orderly development of a river basin. "Watershed Management," says the Commission, "is the foundation of a conservation and development program for soil and water resources....It is based on a recognition that land and water resources are interdependent and must be used so that each reinforces the productivity of the other." Equally significant is the Commission's view that, "One of the most decisive factors in the success or failure of watershed development work in humid areas is the cooperation of the people living in a watershed," and that "...as the concept of comprehensive basin development gains public understanding, the community watershed will be recognized as one of a group of small stream basins which together form the kind of river basin assumed (in this report) as the unit for planning."

These are vital concepts indeed. They pin the ultimate responsibility for watershed conservation upon the people who own, operate, and obtain their livelihood and well-being from the watershed lands. They call upon the land operator's enlightened self-interest, together with his concern as citizen and parent in the future well-being of the entire nation to assure his active participation in the immense job of restoring the nation's wasted resources.

These concepts again remind us that soil and water resources must be maintained under the best possible use our available knowledge permits if we are to survive as a free nation. Properly understood and courageously applied they can be valuable tools to put to immediate, constructive use.

I am gratified to say here that they are closely in line with the thoughts expressed in the message of President Horatio Ford of your Association which appears in the program for this meeting.

## Some Essentials of Watershed Management

How best can we examine and evaluate the specific requirements for watershed management, and what obstacles must we overcome in applying it to our daily activities on the land?

We can take for granted that in a world of constant change, we cannot possibly know "all" about a given subject no matter how simple it may appear at first glance or how thoroughly we may study it. This is especially true for the field of watershed management. Successful practice in this field requires an effective knowledge of the interrelations among climate, geology, soils, plants, water--and people. To the extent we can learn how each factor operates, and how each affects the others, we will more nearly be able to set up standards for sound watershed management. With adequate knowledge we can better determine what practices are harmful to the land--and learn to avoid them. We can also find out what practices are beneficial, and encourage their wider application.

These principles may be illustrated by some basic findings about the nature and functions of the soil in relation to forests and water. First, the soil is a huge and potentially efficient reservoir of moisture and nutrients. This porous skin of the earth's crust can take in, store, and transmit water from rain or melting snow. How effectively soil performs these functions varies with its depth and the size and number of pore spaces. Both depth and pore space are in turn influenced by the character, density, and condition of the vegetation it supports and feeds. The plant cover itself plays an important role in the endless circulating system we call the hydrolic cycle. Its foliage, stems, and litter intercept precipitation, preventing some from reaching the ground at all. And where the soil is fully protected, even violent torrential rains are prevented from splashing the surface soil particles and clogging the pores.

The plants and their litter, by cutting wind movement and shading the soil, reduce water losses by evaporation. They increase the amount of water the soil will hold by supplying it with large amounts of organic matter for conversion by soil organisms into rich, water-absorbing humus. Cavities made by the roots speed the downward movement of water through the soil mass and add to its storage capacity. The roots, by conducting water out of the soil, help make room for more water that otherwise might become part of a flood.

Streamflow is not the result of precipitation alone. It is also an end result of the interaction of soil and plant life. In short, how the water gets into streams, and how fast and clear, is greatly affected by the way land on the watershed is used.

These interrelations are the basis of management and care of forests for soil stability and useful flow as well as timber. Essentially, this type of management requires, first and foremost, that the natural ability of the soil to take in, store and hold back water be safeguarded at all times. This can usually be achieved by intensive fire protection, and by controls over grazing, cutting, logging, or road-building practices to assure the minimum possible disturbance to the soil and its litter, or to the natural movement of water into and through the soil. Aside from the benefits of less soil erosion, surface runoff, and siltation, well protected soil yields a faster and healthier growth of forest products.

These are only minimum requirements for good watershed forestry. Some of them are already being met by the efforts of foresters to stimulate better timber growing practices. The results include better and clearer streamflow, lower costs of treating domestic and industrial water supplies, and less sediment in storage reservoirs. The city of Atlanta, Georgia, for example has greatly benefited by forest protection and improvement and other good land use practices on the 928,000 acre Chattahoochie River watershed, which supplies it with drinking and industrial water. These conservation activities on public and private lands have helped reduce the amount of mud going into the filtration plants from 400 parts per million parts of water, to only 125 parts. Since the cost of sediment removal is a large part of water treatment costs, such decreases save considerable money, in some cases as much as 50-70 percent.

Results of good conservation, as well as neglect, are amply shown by Forest Service studies at the Coweeta Watershed Experimental Forest in the rugged Nantahala Mountains of North Carolina. (Rainfall here varies from 70 to over 100 inches per year and is well distributed throughout the seasons.) Here we found that the removal of the additional sediment produced by uncontrolled logging operations would triple the cost of making the water fit to use. In addition, the value of the soil--even when considered only as fill material--washed away from one section of logging road was five times the sale value of the forest products hauled over that road!

We have already learned the first steps in watershed management--how to reclaim successfully many kinds of sick lands and how to keep watersheds in good health. Now we are about to take a second and perhaps far-reaching step--the deliberate management of forest cover to increase water supplies for domestic, agricultural, and industrial consumption.

This second step goes back to the fundamental relations between water flow and the character, condition, and use of the soil and its plant cover. For example, we have found that where climatic and soil conditions permit, the yield of water can appreciably be increased by timber cutting in some instances, by tree planting in others.

Forest Service experiments on the Coweeta Forest, involving the complete felling of the trees and brush on a small watershed with deep clay soils subject to high rainfall, resulted in a 65 percent increase (17 area inches) in total streamflow the first year, and well-sustained increases over the 10 years since the original single cutting. Last year it still showed an 8 percent increase. This additional yield is simply the water that would normally be used by growing plants. Because the vegetation was left in place--that is, unlogged--to afford full protection to the soil, no erosion took place. In this case streamflow following heavy summer rains was no greater than before. This was because enough water had been withdrawn from the soil by evaporation to provide some storage space, although much less than was available before cutting. Similarly, on the Fraser Experimental Forest in the Rocky Mountains of Colorado, heavy thinning of a dense lodgepole pine stand permitted more snow to reach the ground and increased the amount of water available for streamflow up to about 30 percent.

Of course there are practical limits to such practices. In the first place, climate and soil conditions are not always favorable. In some cases, even clear cutting may produce no increases whatever in water yield and even where these factors are favorable, we cannot afford to go to extremes over large areas in an effort to achieve maximum water supplies. One difficulty is the fire hazard caused by heavy slash accumulations where stands are cut clear to reduce transpiration losses. We must consider the effects on recreation, fish and wildlife, and the threat of soil erosion and heavy sedimentation of water facilities, especially where logging is involved. There is also the danger that careless removal of heavy water-using vegetation along the banks of watercourses may badly upset the stability of the stream banks. We may wish the additional water that this practice can provide, but unless it is clear water, we will only defeat our purposes.

These are some of the problems that need more detailed study. And since we may now expect far greater demands for water from the rapid expansion of agriculture and industry, the urgency of attacking these problems is self-evident.

Forest Service watershed research and flood control investigations are paying ever-closer attention to these aspects of multi-purpose forestry. In the Central States Forest Experiment Station, Hal Morey, John Auten, Richard Gaiser and others are developing and testing the principles and practices that may best accomplish watershed forest conservation at an especially critical period in our history.

In the meantime we must speed up our efforts to apply what we have already learned about the relations of forests, soil, and water. Proper watershed practices can help step up the over-all productive capacity of our major river basins. By healing flood and sediment sources, we can reduce unnecessary losses to crops and water supplies. In short, by applying tested principles of watershed management, by taking all important values of forest land into account, we can produce ample timber and good water on many upstream areas without increasing the flood and silt hazards to downstream farms, industries, and communities.

## Forest Owners Share Responsibilities

Forest land owners and operators, as well as watershed-owning municipalities and industries can benefit by applying these proven principles. But they need much more technical help than is now available. There is a serious lack of trained foresters in both public and private employ who are familiar with the basic requirements of soil and water conservation and control. In this respect forestry lags behind crop and pasture land management.

We must overcome this fault as quickly as possible. The coming years must see a growing emphasis on watershed factors in forestry practices and in technical guidance to private owners. We must learn to pay as much heed to the effects of cutting, logging, grazing, and planting upon soil and water as we now do to timber. Since private lands occupy most of the high water-yielding areas of the country, as well as the sources of damaging flood flows and harmful sediment, it is here that the answers to our water problems must be obtained, and the sooner the better for all concerned. This is particularly true for the humid East, as in Ohio, where most streamflow originates on privately-owned lands.

The progress that has been made is all to the good. But the observant citizen and conservationist know that it is far from enough. Too much forest land, particularly on farms, is still being overcut or harmfully grazed. Many fields which should be clothed in trees or grass lie exposed to erosion. Because the fields and forests are in poor condition, flash floods strike and displaced soil adds to the load of silt which chokes the heavily used waterways of the Ohio River system.

Organizations like the Ohio Forestry Association are eminently fitted to take the lead in finding out how serious the situation is, what kinds of corrective measures should be applied, where, and how soon. They can add their strength to a joint effort to speed watershed restoration and to explore thoroughly the legal and economic obstacles which still impede permanent soil and water conservation on forest lands. In this cooperative effort all public agencies--local, state, and federal--have much to offer in technical knowledge and services, and in educational, financial and legislative facilities. I have no doubt that if the technical and especially the human obstacles to watershed conservation are faced squarely, the teamwork for which Ohio is noted will succeed in overcoming them.

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